# CANADIAN GEOGRAPHICAL JOURNAL

UNIVERSITY OF MICHIGAN
NOV 22 1950
PERIODICAL READING ROOM

NOVEMBER 1950

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As one of its major activities in carrying out its purpose, the Society publishes a monthly magazine, the Canadian Geographical Journal, which is devoted to every phase of geography—historical, physical and economic—of Canada, of the British Commonwealth and of the other parts of the world in which Canada has special interest. It is the intention to publish articles in this magazine that will be popular in character, easily read, well illustrated and educational to the young, as well as informative to the adult.

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# CANADIAN GEOGRAPHICAL JOURNAL

*Published monthly by*
THE CANADIAN GEOGRAPHICAL SOCIETY
36 Elgin Street, Ottawa

*Editor - GORDON M. DALLYN — Assistant Editor - MALVINA BOLUS*

This magazine is dedicated to the interpretation, in authentic and popular form, with extensive illustrations, of geography in its widest sense, first of Canada, then of the rest of the British Commonwealth and other parts of the world in which Canada has special interest.

The articles in this Journal are indexed in the *Canadian Index* which may be found in any public library.

The British standard of spelling is adopted substantially as used by the Dominion Government and taught in most Canadian schools, the precise authority being the Oxford Dictionary as edited in 1936.

Address all communications regarding change of address, non-delivery of Journal, etc., to the publication office, 1,000 St. Antoine St., Montreal, Canada, giving old and new address. On all new memberships, the expiry date will be printed on wrapper containing starting number. This will constitute a receipt for subscription.

Membership dues of The Canadian Geographical Society, which include postpaid delivery of the Journal, are $4.00 per year in any country, payable at par in Ottawa.

*Member Audit Bureau of Circulations*

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Department of Fisheries photo by T. H. Turner

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*Above:—*
*Not all research is done in the laboratory. Here scientists measure and mark trout seined from a stream at Ellerslie, P.E.I., where trout migration studies are being conducted.*

*Left:—*
*Codfish being examined in the bacteriology laboratory of the Atlantic Fisheries Experimental Station at Halifax, N.S. The technologist must know everything there is to know about the changes that take place in fish once they are caught.*

# *Science In Fisheries*

*by* LORNE MANCHESTER

THE CANADIAN PRAIRIES shimmered in the heat on that morning of July 16, 1949, as a long lumbering freight train chugged westward between Watrous and Wainwright. In a tourist coach incongruously hooked on to the tail end of the freight, ten men were watching the flickering needles on a strange array of instruments. The needles were telling a remarkable story. For, despite the fact that the mercury was up to 109 degrees F. outside, the interior of the freight car immediately ahead of the coach was registering a steady temperature of zero degrees F., just what was needed for its 34,000-pound shipment of frozen Atlantic-caught fish destined for Vancouver.

Canadians read about this significant event in their newspapers; how the freight car, specially designed with a mechanical refrigeration unit, completed two coast-to-coast test runs to demonstrate that it could carry perishable foods across Canada in the hottest summer months without the slightest deterioration in quality. Success of the trial runs has been heralded as a possible revolutionary development in the history of frozen food transportation.

The mechanically refrigerated car was designed by the Fisheries Research Board of Canada which has been studying refrigeration and transportation of fish for twenty-five years. The Board's pioneer work in this and other fields has resulted in significant contributions to the Canadian fishing industry. After half a century of probing into Canada's aquatic food resources, the Board today constitutes one of the world's largest and most effective as well as one of the oldest fisheries research institutions. As the scientific branch of the federal Department of Fisheries, it has been metaphorically described as the headlights of the fishing industry, lighting up the hazardous rough stretches of the road and helping the industry to steer with greater confidence.

Records also show that the Board's scientific staff could be described as explorers, prototypes of the Old World adventurers who sailed uncharted seas to find new lands. In 1948, Canada's inland commercial fishermen were bemoaning the fact that the famed Winnipeg goldeye were disappearing from their familiar haunts in Lake Winnipegosis. The Board discovered a new source of supply of this popular food-fish in Lake Claire, Wood Buffalo Park, Alberta, and estimated fishermen could take a quarter of a million pounds a year from the lake without endangering the stock.

The Fisheries Research Board of Canada consists of fifteen members appointed by the Minister of Fisheries for five-year terms. Nine are scientists drawn from staffs of Canadian universities or other institutions, two are representatives from the Department of Fisheries and four are representatives from the fishing industry. This widely represen-

*Thousands of salmon have been netted and tagged to enable biologists to learn something about the spawning habits and migrations of these fish in British Columbia streams.*

tative body brings a wealth of knowledge and experience to bear on specialized problems.

Present Chairman of the Board is Dr. G. B. Reed, O.B.E., Professor of Bacteriology, Queen's University, Kingston, Ontario, while the vice-chairman is Professor J. R. Dymond, O.B.E., Head of the Department of Zoology, University of Toronto. Other university members are, Dr. C. W. Argue, University of New Brunswick; Dr. W. A. Clemens, University of British Columbia; I. M. Fraser, University of Saskatchewan; Dr. J. H. L. Johnstone, Dalhousie University, Nova Scotia; Dr. Georges Prefontaine, University of Montreal, Quebec; and Dr. D. L. Thomson, McGill University, Montreal, Quebec. Representing the fishing industry are K. F. Harding, Prince Rupert, B.C.; R. E. Walker, Vancouver, B.C.; J. H. MacKichan and O. F. McKenzie, of Halifax, N.S. Representing the Department of Fisheries are Dr. A. L. Pritchard, Director of Conservation and Development Service, and D. H. Sutherland who is also Secretary and Executive Director of the Board.

### Early History

The first Canadian Marine Biological Station was built at St. Andrews, N.B., in 1899 after a group of fishery biologists who were studying some aspects of marine biology on the Atlantic Coast were given a Canadian government grant of $15,000. The station was designed as a floating laboratory. It was a small one-storey affair with working accommodation for about a dozen scientists and could be placed on a barge and towed from place to place, looking like a street car body mounted on a scow. In 1908 the laboratory was lost at sea while being towed back to St. Andrews and the following year a shore station was built, with Dr. Joseph Stafford, one of the early investigators (later on the faculty of McGill University) as its first curator.

In the meantime, similar marine studies were begun on the West Coast and through the efforts of the Rev. George W. Taylor, who with several others had been very zealous in urging the need for such an institution, the Pacific Biological Station was established at Departure Bay, near Nanaimo, B.C., in 1908. Mr. Taylor, an enthusiastic and capable student of natural history, was named its first curator.

These two ventures developed into the Biological Board of Canada which was established by an Act of Parliament in 1912. An Act of Parliament in 1937 changed the name to the Fisheries Research Board of Canada.

To provide a foundation for fisheries research, the early work of the Board was concentrated largely on the studies of life histories of Canadian fish—where and when they spawn, factors affecting their hatching, survival and growth, their migrations and conditions determining their numbers.

### Processing Studies Begun

In 1924, studies on processing, storage and distribution were made possible through the establishment of the Atlantic Fisheries Experimental Station at Halifax, N.S. The Pacific Fisheries Experimental Station began to operate in one room in the basement of the old Seal Cove Hotel at Prince Rupert in 1926. A fairly commodious building was later erected on the Provincial Government wharf, and in 1930 a building was constructed at the foot of McBride Street. In 1942 the station equipment and staff were transferred to Vancouver.

In 1929, the substation of the Atlantic Biological Station was set up at Ellerslie, P.E.I., to discover the cause of the destruction, through some infective organism, of the Malpeque oysters and to aid in the re-establishment of the industry. A technological station was set up at Grande Riviere on the Gaspe Coast in 1936 to care particularly for the needs of French-speaking fishermen of the Quebec and northern New Brunswick coasts. In 1944, the Central Fisheries Research Station was established at Winnipeg to handle freshwater fisheries problems. When Newfoundland became Canada's tenth province in 1949, the Board took over the operation of the Commission government's biological station at St. John's. The services

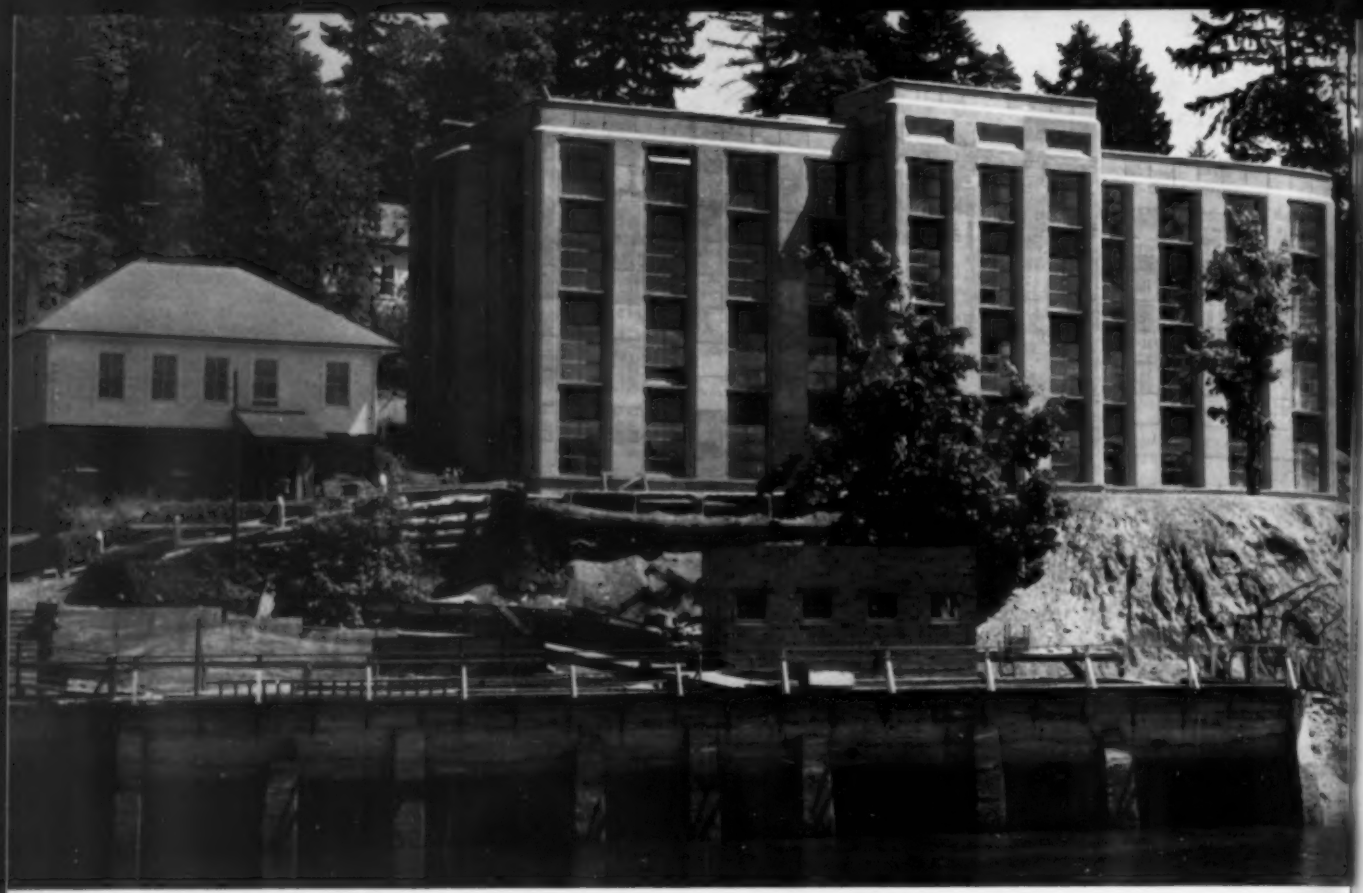
*B.C. fishermen such as these salmon gill-netters, operating near the mouth of the Fraser River, have benefited greatly through the work of the Fisheries Research Board. There is good co-operation in conservation measures.*

of the staff of that station were continued and the work was considerably expanded.

As the work of the Board grew through the increasing demands made on it by the fishing industry, additional buildings and equipment were required. Of particular significance was the opening in 1950 of a new four-storey laboratory on the grounds of the Pacific Biological Station, opening the way to greater opportunities for investigating and developing the fisheries of Canada, particularly in British Columbia. At the same time construction began to provide new space and facilities for the staff of the Atlantic Fisheries Experimental Station. The establishment of these laboratories progressively across the country marked the steady growth of fisheries research in Canada until today the Board is a highly organized, well-equipped body of biologists, oceanographers, chemists, bio-chemists, bacteriologists and engineers, carrying out a greatly expanded program of work vital to the economy of Canada.

The general types of work carried out are biological and technological. Biological work now is centred in four stations, the Atlantic Biological Station with its substation at Ellerslie; the Pacific Biological Station, the Central Research Station and the Newfoundland Biological Station. Technological work is conducted at the Atlantic Fisheries Experimental Station, the Pacific Fisheries Experimental Station, and the Gaspe Fisheries Experimental Station.

Results of the Board's researches are applied in the management of fisheries through the operation of the Department of Fisheries and are made freely available to the fishing industry. However, there is usually a transition stage between research and application



*The new biological laboratory at Nanaimo, B.C. is dedicated to studies of salmon and other fish of British Columbia waters.*

in which the Board and the Department or industry co-operate in adapting results to full practice corresponding somewhat to the pilot plant stage in the application of research to manufacturing industries. The Board's findings are printed in several types of publications and circulated continually to industry and other organizations.

*Salmon tagging is a simple operation, done quickly by experienced hands.*

### Biological Investigations

The Board's biological researches are directed at increasing knowledge of the fish and aquatic organisms found in Canadian waters so as to make possible the fullest utilization of them. New frontiers are continually being explored. For example, Great Slave Lake in the Northwest Territories now supports a commercial fishing operation of considerable importance. Some nine million pounds of whitefish and lake trout are taken from the lake each year. Prior to 1944 when the Board's scientists investigated this great body of water, fifth largest lake on the continent, its resources were practically unknown to the industry.

Canada's Eastern Arctic became the scene of fishery explorations in 1947. Each summer since then, the Board's scientists, working on a specially-built motor vessel, the *Calanus*, have obtained valuable biological informa-

tion on the marine resources of Ungava Bay and Hudson Strait. So far they have found that both the Atlantic cod and the Greenland shark provide possibilities for a fishery by the Eskimo population of Ungava Bay.

Other exploratory work by the Board resulted in the discovery of large commercial quantities of the tasty rosefish in Hermitage Bay, Newfoundland, and new supplies of American plaice and cod down the eastern edge of the Grand Bank. The Irish moss industry in the Maritime Provinces and the inshore flounder fishery off certain sections of the Nova Scotia coast were both developed as a result of the Board's efforts.

The very nature of the existence of fish —they cannot be kept under continual observation in their natural habitat—poses a number of baffling questions which scientists in many countries have been trying to answer. Fish populations are notorious for their wide fluctuations. An abundant species may in a year or two become scarce. This results in an instability in volume of production from season to season—a feast-or-famine cycle—which sometimes has disastrous results. Pilchards are an example. These little Pacific Coast fish, upon which a big meal and oil business was built in British Columbia, disappeared in 1946 just as suddenly as they had first made their entry into that province's waters two decades ago!

Many of these drastic changes in abundance are undoubtedly due to climatic or other natural conditions, in which case the Board can do little about them at the present time except try to foretell years of scarcity and years of abundance. To determine causes of fluctuations in abundance of fish, scientists must delve into their breeding and

*The salmon resources of B.C. annually provide great quantities of high protein food for Canada and other countries throughout the world. Science plays its part in perpetuating this great industry.*

migratory habits, rate of growth, effects of climatic conditions and salinity and temperature changes in the water, and natural enemies. Studies of this nature were recently begun on the albacore tuna which was discovered in large numbers off the West Coast by Fisheries patrol boats in 1948. This often involves years of patient, painstaking study and even then knowledge is not always complete. It is only by this knowledge, however, that some of the guess-work will be eliminated from the fishing industry and the fishermen will be helped toward a more secure economic future.

If the changes in abundance are related to the fishing efforts, then the Board can draw on the results of its investigations to recommend sound regulatory measures to keep man from killing the goose that lays the golden eggs. The Board also can take positive steps to see that the environment is improved so that the fish will thrive.

Another phase of the Board's biological work is concerned with those fisheries which are intensively fished because of their wide popularity as a food dish. Production is principally limited by supply and the concentrated fishing efforts in these fisheries can lead to reduction of stocks to a point where fishing is no longer profitable. The Atlantic lobster and the Pacific salmon, to choose two examples, are in this class and it is only by wise management of these fisheries, through sound regulations, that a continuing maximum yield can be maintained.

The Atlantic lobster at one time was taken in unregulated quantities. Demand was high, prices were good and the aim was to take as many as possible during the season. Possibility of exhausting the supply was not considered by the fishermen until evidence indicated that such a thing was happening. The Board's scientists made exhaustive studies of lobster populations, their breeding habits, movements and rates of growth. As a result conservation measures such as size limits and closed seasons were drawn up to attempt to ensure sufficient reproduction for a continuing yield. When it is realized that the lobster fishery is the most valuable of our Atlantic inshore fisheries, the significance of the Board's work to the East Coast fisherman can be appreciated.

*Inset:—A Pacific herring with tag partially inserted in incision.*

*Below:—Increased knowledge of fish and aquatic organisms found in Canadian waters is made possible through research vessels such as the "Investigator I" at the Nanaimo station.*

*Scientists now make successful catch predictions in the British Columbia herring fisheries. Purse-seiners take many tons in a single "set".*

The investigation on Pacific salmon was one of the early projects of the Pacific Biological Station. As far back as 1925, scientists were busy removing certain fins from the various species of salmon in marking experiments to determine their movements and migratory habits. At the same time, a study was underway on the propagation of sockeye salmon to try to find out whether artificial means of increasing the stock, such as by hatcheries, were really better than natural propagation by the fish themselves. Conducted over a long period of years, these and other studies have enabled the Board to solve some of the mysteries associated with the life of this king of fishes.

Regulations, based on scientific investigation, are designed to ensure that sufficient salmon escape the fishermen's nets at the mouths of the rivers to reach the upper regions to spawn. Letting a certain number of fish get away does not always have the desired result. Factors other than man often enter the picture and upset all calculations, bringing anxiety to the industry and headaches to the scientists.

For example, in 1944 the Board's fishery scientists were asked to investigate the salmon fishery of the Skeena River* after it became evident that the pink and sockeye runs in this northern British Columbia river were declining.

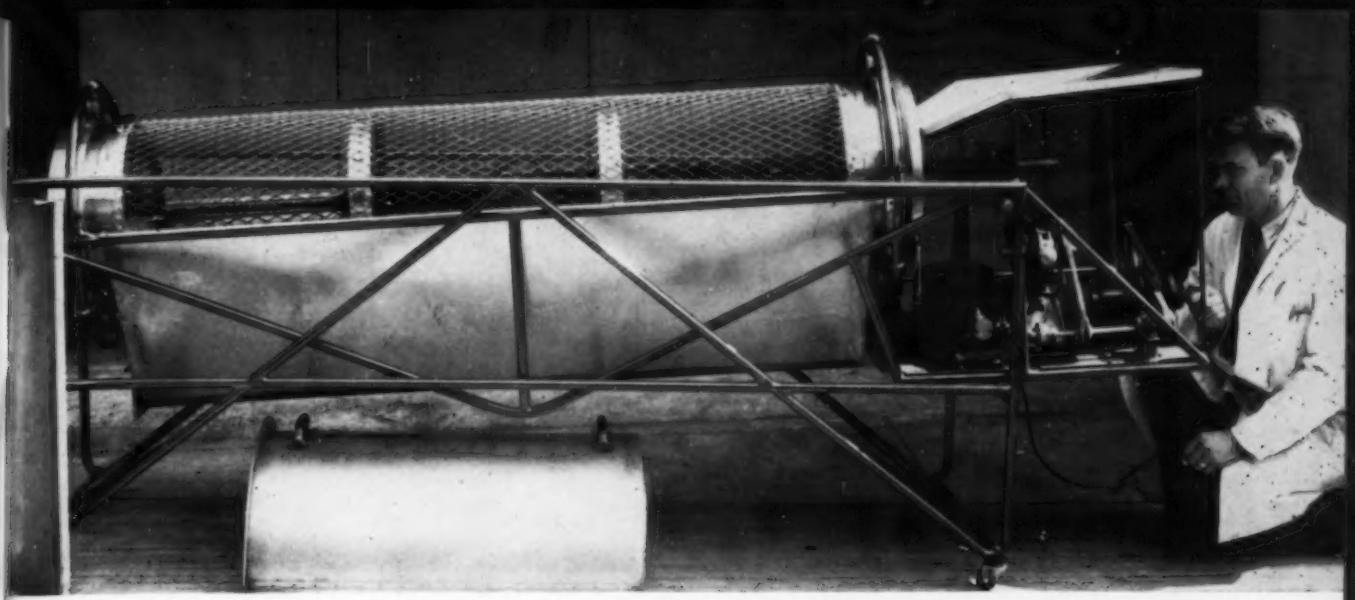
*See The Skeena River Salmon Investigation, A. L. Pritchard, Canadian Geographical Journal, August 1949.

The Board's survey showed that steps were definitely needed to rebuild the runs. Although expansion of commercial fishery operations was considered to be one of the reasons why populations were being kept down, other factors such as adverse weather conditions, obstructions hindering migration, silting as it affects conditions on the spawning beds and predation especially by harbour seals but to some extent by other fish, were strong influences. As a result, certain remedial measures were put into effect pertaining to fishing regulations, stream improvement and reduction of predators.

On the East Coast, a few years ago, low catches of cod and haddock by off-shore schooners and trawlers caused widespread fears that stocks of groundfish on the "banks" were being "fished out". Some of the blame was cast on the ships which came from many countries across the seas to this great marine feeding ground. Scientists at St. Andrews Station undertook an extensive study and emerged with astounding but reliable figures to show that despite the fact that the "banks" had been fished by many nations since the time of Cabot, there was no sign that the stocks were being reduced. Their studies, however, are being continued to enable them to detect symptoms of overfishing should it occur.

Studies of catch fluctuations in various fisheries have produced some outstanding results. For example, on the West Coast hundreds of thousands of tons of herring are used to make fish meal and oil in British Columbia. The Pacific Biological Station undertook studies designed to provide information on the most successful management policy which could be developed to provide

*Refrigeration principles developed by the Board were incorporated into the design of the cooling facilities (inset) in the hold of this new steel-hulled fishing vessel.*



*A machine evolved by the Pacific Fisheries Experimental Station for salvaging flesh from fish trimmings. The fisheries technologist works to eliminate waste.*

a maximum sustained fishery. The resulting information on size and age class groups enabled the station's scientists to predict, in advance of the season, not only the place where the fish would make their appearance but the approximate size of the catch!

The up-and-down catch figures of the Atlantic salmon, one of Canada's most highly regarded sport fishes, also were passed to the scientists for explanation and much investigatory work has been done. Researches now suggest that fluctuations in abundance are related to rainfall. Low water at spawning time in the fall has been found to have serious local effects on reproduction. In some streams fish-eating birds removed a large part of the stock of young salmon, particularly in dry seasons when the water was low and clear. Here were examples where natural causes, not over-fishing, were to blame. Bird control experiments conducted by the scientists resulted in a great increase in young salmon but were accompanied by a similar increase in other kinds of fish which prey on the young salmon.

The Board's interest in conservation has also extended to whales and seals. Whales

*Recording winter temperatures of spawning beds at Babine Lake, B.C., where salmon eggs will hatch in spring.*

occur off Newfoundland where they are of considerable economic importance, and off British Columbia. Since the sealing fisheries of Newfoundland are commercially valuable, the Board has begun a study of the seal populations off the Atlantic coast as a preliminary step to the recognition of signs of over-exploitation.

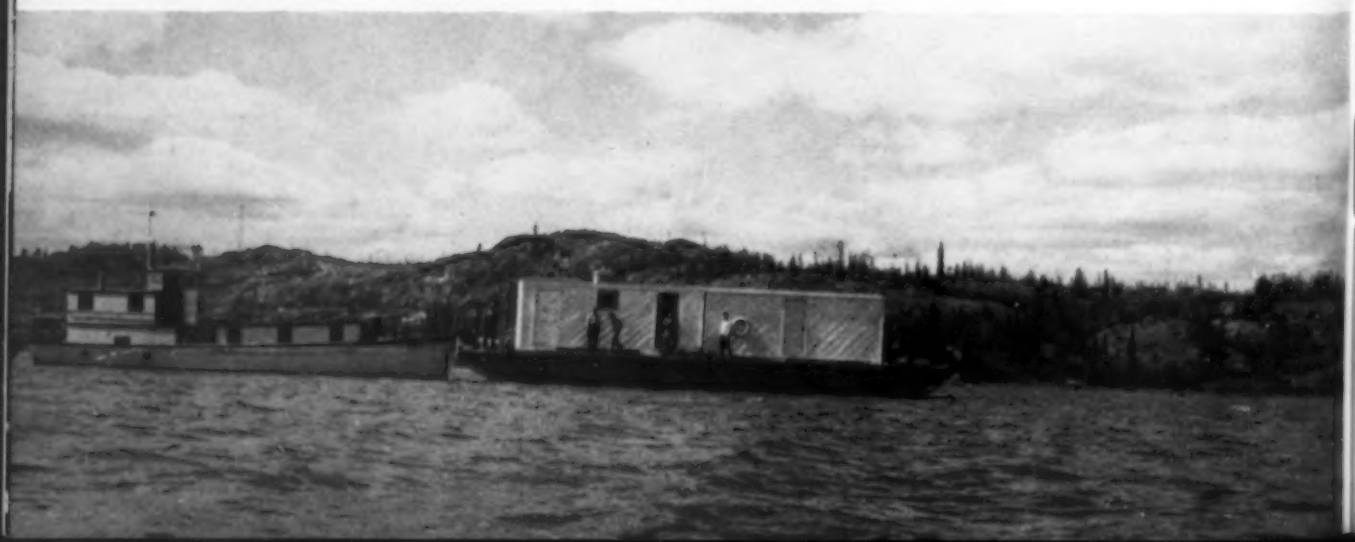
Although most of the research to improve the quality of fish as marketed is classed as technological work, control of some of the conditions which affect quality is being sought through biological studies. Raising the quality of whitefish originating in the Prairie Provinces and in northwestern Ontario has been under study for some time and in fact was the reason for the establishment of the Central Fisheries Research Station in 1944. Although this station is now concerned with all research problems concerning the fisheries of the area from Port Arthur to the Rockies, the whitefish investigation is still one of its chief responsibilities.

Apart from managing the fishery so as to assure the maximum sustained yield, the only means of increasing production is to make conditions more favourable for hatching, survival and growth. Techniques being developed to this end include oyster farming, pond culture of trout, reduction of competitor and predator species as in Atlantic and Pacific salmon, increasing productivity of waters by fertilization and increasing areas for spawning and growth under natural conditions and through hatcheries. Perhaps the most significant accomplishment in the field of culture so far has been in connection with oysters. As far back as 1929 oyster culture practices were investigated and developed to the extent that a large oyster farming industry was established and expanded. The first cultural experiments were begun on the Bideford River in Prince Edward Island. At the same time, the Board's scientists undertook to discover what had caused the infection of a bed of oysters in the Malpeque Bay. Work was conducted from the special substation at Ellerslie. Existence of disease-resistant stocks was demonstrated and these stocks were developed to rebuild the beds in the area. Cultural practices were developed by the Board, followed by continuing investigation on improvement in techniques, reducing costs of production, and extending the industry to new areas.

### Improvement of Fishing Methods

Stimulated to some extent by the food demands during World War II the fishing industry in recent years has made great strides in modernizing its methods of catching fish. Today, in most cases, it is a highly mechanized operation. Echo sounders, aided by other electrical devices, are used to detect schools of fish both vertically and horizontally in mid-layers of water where formerly it was not known that they existed. Radios are becoming standard equipment on even

*Exploring for new fishery resources, scientists working from this barge at Great Slave Lake, N.W.T., found great quantities of whitefish and lake trout which are now the basis of an important commercial fishery.*



*The* Calanus, *specially built for explorations for new fishery resources in Canada's eastern Arctic, lies anchored near shore ice at Port Burwell, Ungava Bay.*

the smallest of fishing vessels, enabling fishermen to maintain constant communication with each other and to pass the word when schools of fish are located. But some sections of the industry, particularly on the East Coast, have not progressed as rapidly as others and the Board has concentrated its efforts in these areas.

Besides successfully introducing flounder-dragging to the inshore fishermen of St. Mary Bay and Minas Basin in Nova Scotia, scientists at St. Andrews Station have done con-

*A Greenland shark is dissected aboard the* Calanus.

*A Lake Winnipeg fisherman sets his gill-net under the ice with a "jigger". Quality of the whitefish he catches is a chief concern of the Board.*

siderable experimental fishing with various types of gear, not formerly in common use. Demonstrations of the use of powered haulers in small line-fishing boats led to their widespread adoption in the inshore fishery, especially in western Nova Scotia. Tests were conducted with the Danish seine which offers some promise as a means of catching flatfish in Chedabucto Bay. The use of up-to-date gill-netting equipment on the East Coast is being studied and comparisons are underway on the relative effectiveness of various baits used in certain fisheries.

### Physical Oceanography

Poor fishing is not always due to scarcity of fish. Fish may abound but if the fishermen cannot find them or cannot catch them in sufficient numbers, fishing is unprofitable. Temperatures, salinities and currents in the sea are factors influencing not only the movements and occurrence of fish but their hatching, survival and growth. For instance, the Board's scientists noted that haddock on the Grand Bank in March and April, 1948, were in deeper water than in 1947 and that this corresponded with temperature differences in the two years. Off the West Coast of British Columbia, scientists found that the best fishing for albacore tuna occurred in waters with temperatures between 58 and 60 degrees F.

Physical oceanography is therefore of basic importance in efforts to understand the abundance and distribution of life in the sea. The data compiled for biological purposes at the Pacific Biological Station and the Atlantic Biological Station prior to World War II were found to be most valuable for defence purposes.

Following the war the co-operative arrangements that had been developed for defence were continued under joint arrangement, when, in 1946 after consultations between officials of the Board, the Department of National Defence and the National Research Council, a joint committee on oceanography was appointed. This Committee has representation from the Royal Canadian Navy, the National Research Council, the Fisheries Research Board and the Canadian Hydrographic and Meteorological Services. Oceanographic vessels furnished by the Navy are in operation on both coasts and accommodation for the Committee's work is provided at the St. Andrews and Nanaimo

Stations. Continued studies on physical oceanography are considered to be of the greatest importance.

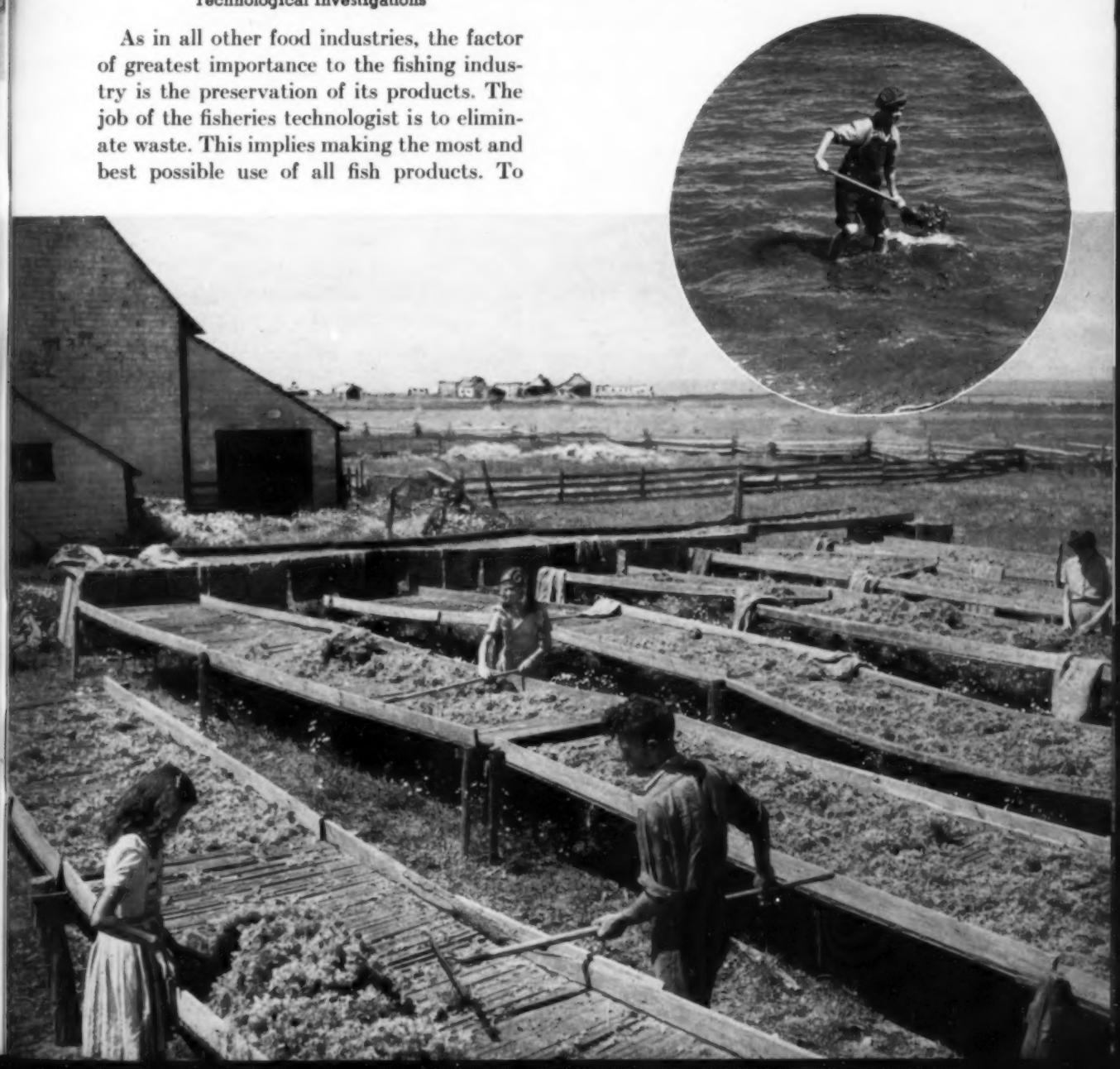
Under the Committee, a Chief Oceanographer directs the work of the Atlantic and Pacific Oceanographic Groups. Cruises of the Gulf of St. Lawrence have furnished information on temperature and salinity of these waters as a background for intelligent fishery investigations. One important result in 1949 was that some outstanding information on the positioning of the northern edge of the Gulf Stream, and the currents associated with it, was obtained.

### Technological Investigations

As in all other food industries, the factor of greatest importance to the fishing industry is the preservation of its products. The job of the fisheries technologist is to eliminate waste. This implies making the most and best possible use of all fish products. To

*Below:—*
*Scientists of the Board have helped to develop the industrial uses of Irish moss. It is now an important source of income to the Maritimes.*

*Inset:—Gathering the moss from shallow sea-water.*



*Suspended under water, these devices — cardboard egg cases hardened with concrete — collect oyster larvae or "spat".*

*New methods of oyster farming are developed at Ellerslie, P.E.I.*

accomplish these ends, the technologist must know everything there is to know about the fish and the changes which take place in its flesh from the moment it is caught. Improving methods of processing and preserving fish, studying its nutritive value and increasing the range and value of fish by-products for food, medicinal and industrial use are the aims of the Board in this respect.

Fish when caught are highly perishable and require a great deal more care in handling than other protein foods. There is an old saying that richness begets frailty and the better the food the more likely it is to go bad. Therefore, the need for proper handling, proper processing and adequate low temperatures in storing and transporting fish presents another set of problems to solve if the industry is to prosper. Here again the Board's scientists have come forward with solutions which have been a boon to the fisheries.

Investigations are carried out in its laboratories as well as on fishing vessels, in fish processing plants, and on railway cars.

Early in their studies, the Board's scientists found that low temperatures were effective in controlling the changes in the flesh constituents of fish once landed. They proved that newly caught fish rapidly cooled to 32 degrees F. and kept at that temperature or close to its freezing point retained its original flavour for a longer period. The resultant examination of the cooling processes used in the industry indicated many opportunities for improvement. As far back as the early

*Oyster fishermen, with scissor-like tongs, rake Malpeque Bay oysters from beds developed scientifically.*

*at Ellerslie, P.E.I., where experimental oyster beds are under culture.*

*A scientist at St. Andrews Station cuts the gonad wall of the oyster, in experiments to predict possible spawning date.*

1930's, scientists at the Pacific Fisheries Experimental Station showed the halibut industry on the West Coast that certain icing techniques could control the discolouration or yellowing of halibut which was occurring while the fish were stored in the pens aboard ship. The Board's research resulted in the saving of large sums of money for the industry and at the same time improved the quality of iced halibut for the consumer. The three technological stations have repeatedly carried out experiments with Canadian-caught fish to demonstrate the importance of the principle that fish must be clean, cold and carefully handled if it is to reach inland housewives and restaurants with its full flavour.

Not long ago, an East Coast fishing firm, following recommendations by the Board, re-designed the cooling facilities in the holds of one of its "Banks" schooners as an experiment. The first catch of fish, unloaded at dockside after the changes were made, proved to be in better condition and of better quality than on any previous trip. In fact, the results were so outstanding that the Board's principles on refrigeration were incorporated in the design of a new class of trawlers being built in both Canadian and British shipyards.

In the handling of fresh fish in plants which produced fillets and other fresh fish products, the application of the principles of cooling presented a new set of problems to the investigators. Laboratory experiments

*The Board is presently engaged in improving techniques for reducing costs of oyster production and extending the industry to new areas.*

*Equipped with a net-towing boom, this Research Board vessel is used to study marine life off Canada's Atlantic coast.*

*Below:—Close-up of cone-shaped plankton net towed astern of the vessel.*

pointed to the importance of thoroughly washing the fish prior to the cutting operations and the need for fast handling and rapid cooling. The Board has developed an economic but effective fish washing machine, experimented with fish filleting machines and improved the keeping quality of fillets or other cut fish by rapid cooling, after cutting, in air flow freezers.

Recently a Vancouver cold storage plant installed a unit embodying the jacketed system of cold rooms developed in 1927 by the Board.

A machine has been designed for recovery of edible fish flesh from certain types of waste. A method of preparing albumen from fish as an egg white substitute has been explored and developed to the state of utilization. Methods have been developed for the preparation of peptones from fish waste or meal. Many of these products, if produced commercially, would come into competition with similar products from other sources, and accordingly costs of production have to be investigated.

The preservation of fish by dry-salting, immersing in salt pickle and sun-drying, is so ancient a method that no exact record exists of its origin. Canada's dried fish industry has always been an important factor in the development of her foreign trade. The dependence on the sun and the wind for drying, however, and the methods of salting, resulted in a lack of uniformity in the product. Scientific methods are now being used. A salt fish dryer was developed by the Atlantic Fisheries Experimental Station and this equipment is operating successfully. More than fifty are in operation in the Maritime Provinces.

In the early years, canning of sea fish received much attention and many operations now in use in the industry are based on these studies. Latterly a series of experiments was conducted by the Pacific Experimental Station in the canning of freshwater fish and methods were devised for canning frozen

whitefish and other species which yielded a good product. On the basis of these procedures, commercial firms are establishing canneries in the central provinces.

A large amount of information has been accumulated on the nutritive value of the various species of Pacific fish as human food in contrast with other forms of protein foods. Most species of fish are shown to have a very high nutritive rating. Freshwater fish have also been subjected to food value analysis. Extensive assays have been made for the "animal protein factor" in fish and fish products. This factor (or factors), now recognized to be essential for proper growth of animals and man, is available from a variety of sources. The analysis by the Board indicates that it is present in large amounts in the livers of several species of fish, in condensed fish solubles and fish meals, especially whole herring meal. This knowledge should enhance the acceptance of these products as animal foods.

The Board co-operates with the National Research Council and the Department of Agriculture in the activities of the Canadian Committee on Food Preservation which serves a valuable purpose in the interchange of information on related preservation problems. A subcommittee on fish brings together all workers concerned with technological fisheries research in the federal and provincial fields as well as in the universities.

Perhaps one of the more important contributions of the Board has been the development and processing of oils, particularly vitamin potent oil. In 1941 these studies were brought together and published in bulletin form by the Board. Since then the bulletin has been widely used in Canada and wherever fish oils are prepared throughout the world.

A new method of extracting oil from fish livers was developed recently at the Atlantic Fisheries Experimental Station. The method recovers 95 per cent of the oil from cod livers and the residue, which is left intact, provides a valuable protein source rich in vitamin B complex and the "animal protein factor".

*Above:—Contents of the net are emptied into test jar to be taken to laboratory for microscopic examination.*

*Lobster larvae and other forms of sea life, picked up by a tow net, are examined on board.*

*Oceanography is given an important place in the Board's program since temperatures, salinites and currents affect the abundance and distribution of life in the sea.*

In the non-medicinal oil field, the Board's investigations have included herring, whale and seal oils. Improved processes for herring oil have produced a highly palatable margarine oil.

Utilization of fish wastes has always been an important phase of the Board's technological work. One of its first investigations in this sphere was in 1929 when it became concerned with the possibility of making glue from fish waste on the Pacific Coast. At that time there were only two or three companies in Canada and the United States engaged in the manufacture of fish glue and their methods were kept secret. These companies were on the Atlantic coast. The opinion of these firms seemed to be that fish waste available on the Pacific coast was unsuitable for fish glue. The Pacific Fisheries Experimental Station, in a series of experiments, proved otherwise and fish glue became a by-product of the West Coast industry.

More recently, the Board's investigators have developed processes for obtaining protamine (used in insulin preparation and other pharmaceuticals) from salmon milt, insulin from halibut, lingcod and whales, decolourizing carbon from herring scales. It has developed marine oils used in chemicals, protective coatings, rubber, tanning and textiles.

### Challenge to Fisheries

Fisheries research in Canada therefore follows two fields of endeavour, one concerned with obtaining a continuing maximum yield of the raw material and the other with elim-

*Gaspe fishermen for years have depended on the sun and wind for drying their codfish. The trend today is towards artificial driers, developed by fisheries technologists.*

inating waste to obtain peak quality production. While the two are linked and one is often the precursor to the other, the line between them seems to be clear-cut. The biologist and the technologist operate on different planes, one in the water and one on land. Each has his special training and each faces different problems. The technologist perhaps has the advantage, for he has some control over the products with which he works and their environment. The application of his research results depends largely on the choice of industrial management. But how control the fish which are creatures of a world man has not penetrated? The sports fisherman who casts his fly on the surface of an untried mountain pool thrills to the gamble of the strike. He calls it luck and who can say otherwise!

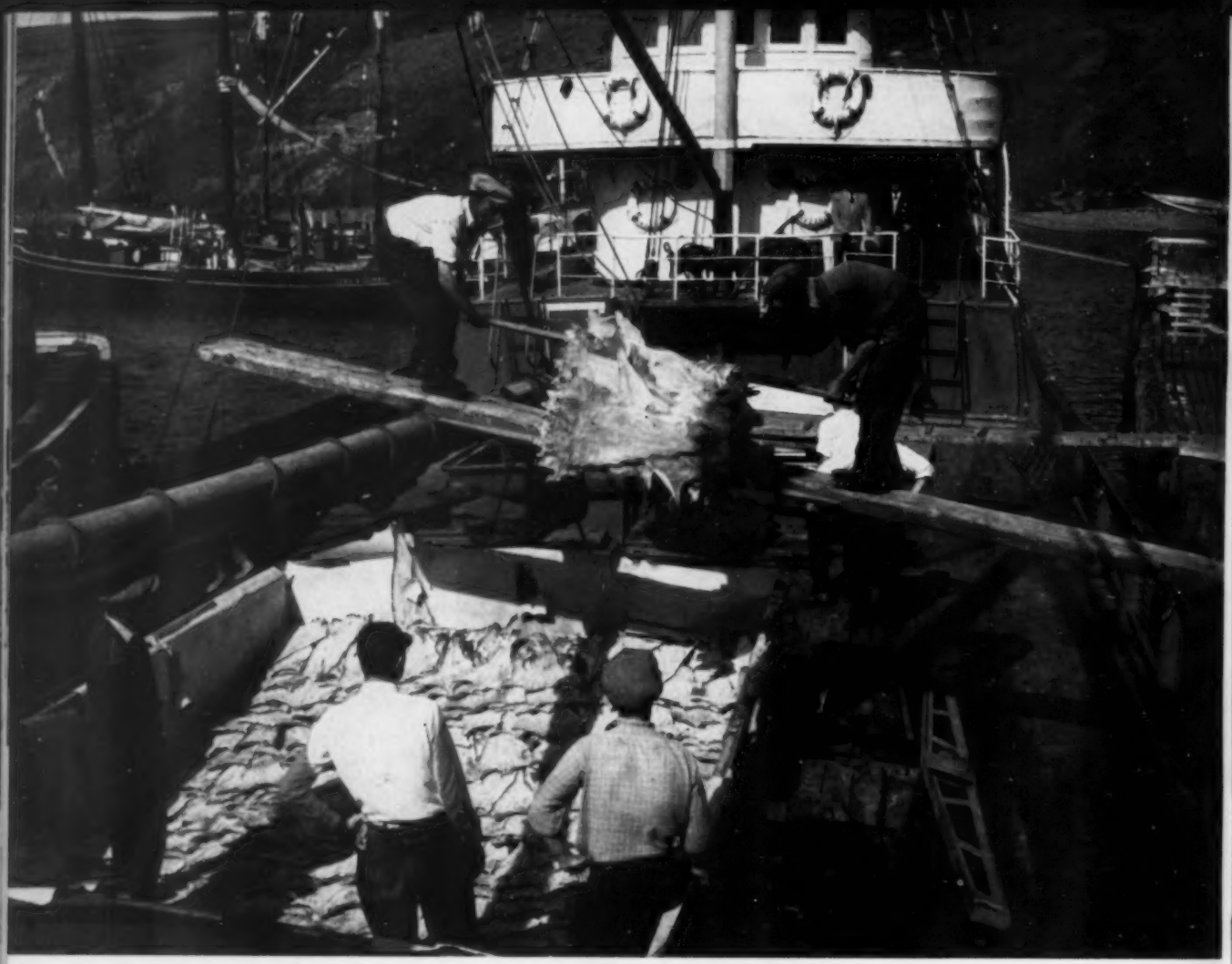
But the commercial fisherman who invests his capital and stakes his living on his catch and the industry in general must trust to the same luck in many cases—luck combined with knowledge gained through past experience and old-wives tales. The fisheries biologist has added his contribution to solve the enigma of the fish but even now the picture is not clear. To take an example, when the young herring failed to make their regular appearance in their normal haunts along the East Coast in the winter and early spring of 1950, hundreds of fishermen suddenly found themselves unemployed. With weirs empty, the sardine canning industry built on the basis of this fishery, was at a stand-still. The fact that the fish appeared a few months later did not help matters much since they were then too big to be sold as sardines which find such favour in the Canadian market.

What made them suddenly break a long-established habit? Where were they? What will happen next year?

Again, what happened to the ten million sockeye salmon who were supposed to make their appearance outside the mouth of the Fraser River in British Columbia in the fall of 1950? The progeny of those fish which spawned in the Adams River tributary of the Fraser four years ago numbered less than twenty per cent of the anticipated run and caused considerable financial loss to the fishermen as well as embarassment to the biologists. What happened to the rest of the run? Were they lost at sea? Did they ever get past the egg stage? Or were the young fish swamped when they tried to get down river to sea in the great Fraser River flood of 1948?

These are questions to perplex the biologists and, in essence, constitute the challenge

*The fresh and frozen trade has boomed as a result of improved methods of handling and packaging. These girls are wrapping fillets in a modern plant at St. John's, Newfoundland.*



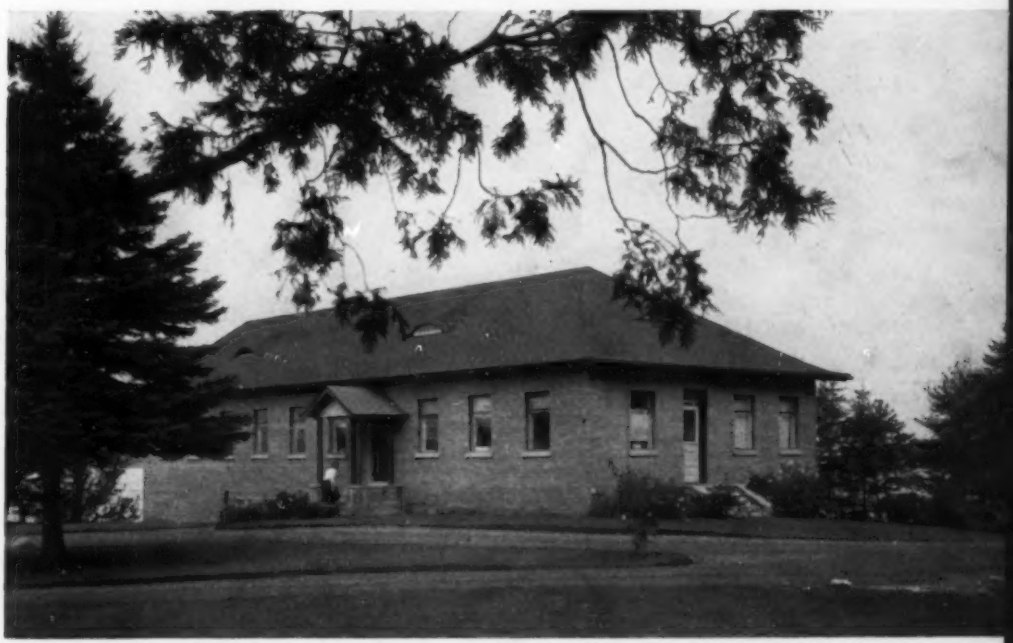
*Dried cod-fish, being loaded in Newfoundland for the Portuguese market, is now processed scientifically, resulting in a more uniform product.*

facing the men who match wits with nature. The problems of fisheries are perhaps unique compared to other resource developments. The farmer has his herds of cattle under his eye at all times. On one piece of land he can experiment with ten different soil compositions. He can call in the soil chemist and the animal husbandry expert who can study the particular problems at first-hand and provide solutions based on unalterable case histories. But the fisherman's problems are more complex. The waters on which he operates cover feeding grounds which might differ with each contour of the shore-line. The matter of determining the best bait for a particular species of fish, for example, involves a long tedious process of actual fishing experiments. How hungry the fish were and how many saw the bait would be factors not easily assessed but affecting the results.

The twentieth century has seen the application of science to industry, the tempo of which has increased greatly as a result of World War II. But the fishing industry, with its special needs, has not enjoyed the benefits of extensive co-operative research organizations such as those of corporations and universities.

The Fisheries Research Board of Canada is comparatively a small group of scientists tackling a tremendous task almost single-handedly. The road is long, the hurdles are many and the odds are with the fish. But if past achievements are any criterion, the Board has made a head-start. It should continue to make great progress in the expansion and development of this Canadian resource.

*Proper stowing and icing practices on board this otter-trawler bring fish from the Grand Bank off Newfoundland to market in fresh appetizing form.*



*Main building of the Atlantic Biological Station at St. Andrews, N.B., where biologists have made significant contributions to the knowledge of the habits of marine and freshwater fish.*

## *Operation Fiordland*

### *New Zealand—Part II*

While the wapiti experts were carrying out their investigations, the other scientists of the expedition — botanists, land and marine biologists, geologists, ornithologists, entomologists, surveyors, and so on, were busy in their own particular fields of research. They too covered a big area of Fiordland, collecting specimens and information for detailed study in more suitable conditions than the rainy forest or the tents of their base camp.

Deputy to Dr. Murie as scientific leader of the expedition was Mr. A. L. Poole (above), director of the botany division of the New Zealand Department of Scientific and Industrial Research.

Dr. Pierre Danserau (lower left), botanist and ecologist of the University of Montreal, visited Caswell Sound and the base camp. He is seen collecting specimens of orchids (*Earina autumnalis*) which are plentiful along the Fiordland coast, and what is commonly called the kidney fern (*Cardiomanes reniforme*).

Right:—Mr. R. I. Kean, senior biologist of the New Zealand Wild Life Branch, on the steep slopes above the timberline, at an altitude of about 3,500 feet. He is collecting grasses eaten by wapiti and birds, such as the kea and the kakapo.

The only woman scientist who took part in the expedition was Miss R. Mason, of the Botany Division of the Department of Scientific and Industrial Research. In the picture below she is shown collecting specimens in the high country near Henry Saddle. The bush is *Olearia crosby-smithiana*, a species confined to the Fiordland and not very well known.

The tree fern (*Cyathea smithii*) which abounds in the rainy bushland.

Clumps of another fern common t
*Blechnum sco*

Another type of alpine flower plentiful in Fiordland, *Gentiana montana*.

Bull kelp (*Durville antarctica*) hic
southern as

common the southern Fiordland, the *Blechnum discolor*.

An alpine daisy (*Celmisia holosericea*), one of a species confined to Fiordland.

*tarctica*) which is abundant off New Zealand's southern coasts.

A bush of cutty-grass (*Mariscus ustulatus*), so called because of its sharp-edged leaves.

Members of the Geological Survey, another branch of the Department of Scientific and Industrial Research, accompanied the expedition. Above A. C. Beck and Dr. D. A. Brown examine rock formations in the Stillwater River.

Below:—Back in camp they examine and list some of their rock specimens.

Ornithologists of the party, led by Dr. W. R. B. Olliver, former Director of the Dominion Museum, studied the birdlife of Fiordland, observing, collecting and photographing.

The weka (two are shown above) is a woodhen, of reddish brown or blackish colouring, common in the Fiordland forests, in scrublands near the sea-shore or on the edges of lakes and swamps. It is a very inquisitive and acquisitive bird. Numbers were found near the expedition's base camp, where the men had to take special care to see that belongings were not left lying around for the weka to pick up, even from inside tents. What is known as the South Island weka (*Gallirallus australis*) is common in Fiordland, but there are even greater numbers of the black weka (*Gallirallus troglodytes*) which is of a brownish black colouring.

New Zealand's emblem bird, the flightless kiwi, was heard calling, and feathers and part of an egg were found, but none were seen. Another bird of which specimens were seen but not photographed, was the kakapo (*Strigops habroptilus*), a large green parrot peculiar to New Zealand. The kakapo is fairly rare in the South Island and believed to be extinct in the North Island. Its most remarkable feature is that it is in process of losing the power of its wings and now can only glide from tree tops to the ground or to lower branches.

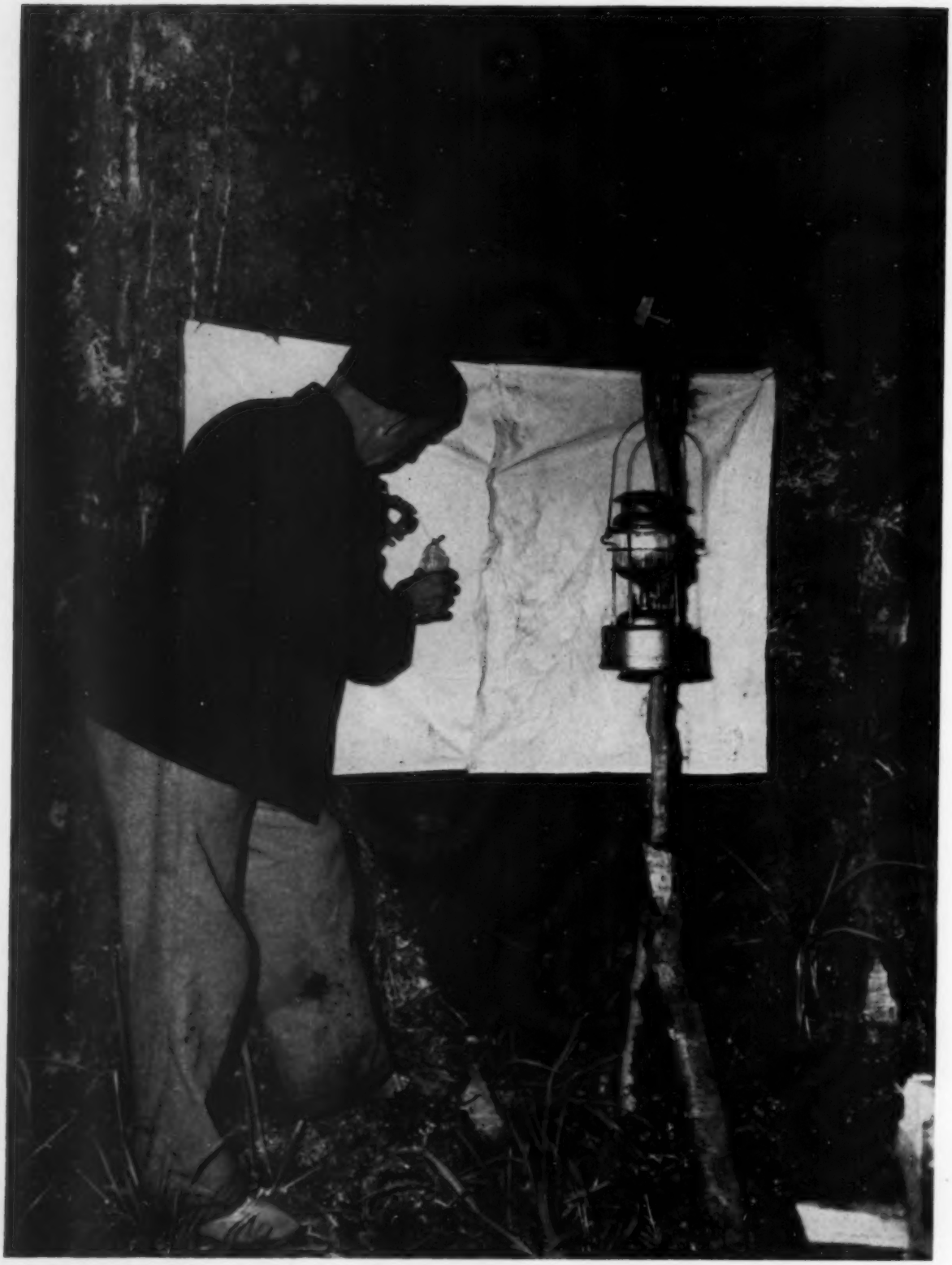
Below:—One of the friendliest birds was the South Island tom-tit (*Petroica macrocephala*). They were numerous and comparatively tame. The one photographed is a male.

Above:—A bell bird or korimako (*Anthornis melanura*) feeding on the berries of the *Coprosma rotundis folia*. The bell bird gets its name from its remarkable flute-like or bell-like notes, generally uttered as a chime of four. The name is well deserved and to hear a number of bell birds singing together is a memorable event. It is an excellent mimic of other birds' calls. Of olive brown to olive green colouring, it feeds on insects, berries and nectar.

Below are shown two Blue Mountain ducks (*Hymenolaimus malacorhynchus*). Of slatey blue colour, with a darker blue about the head, these native New Zealand ducks are fairly rare, and are found only in mountain streams. They feed on insect larvae in streams and lakes. Their whistling cry is the origin both of their European name of whistling duck and the Maori name of *Whio*.

Other birds which frequent the southern coast and islands are the mutton birds or sooty shearwaters (*Puffinus griseus*). This migratory bird travels to the coasts of British Columbia and California. It is a delicacy for eating but is now protected and may only be taken by the Maoris. During the open season descendants of the original Maori owners spend some weeks on the mutton bird islands, catching the birds by pulling them from their burrows. The shearwaters are salted and preserved in bags made from slit bull kelp (page 17) which are packed in casks or baskets protected with bark. In this way they will keep for a year or more.

One of the most common birds in mountainous Fiordland is the kea (*Nestor notabilis*), shown on the right. Below, at 3,900 feet, Dr. Murie photographs a kea while its attention is attracted by a red handkerchief. Found only in the South Island, the kea lives on the higher mountain slopes above the forest line. It is a most inquisitive bird and can be examined closely. It feeds on insects, worms, grasses, berries and young roots. So bold is the bird that one of the scientists was bitten in the leg by one. In certain areas the kea is reputed to have acquired a taste for the fat of sheep kidneys. To gratify this strange taste, high country sheep men declare that the kea kills sheep and lambs, stripping the back of the carcases to get at the kidney fat. The remainder of the carcase is left untouched.

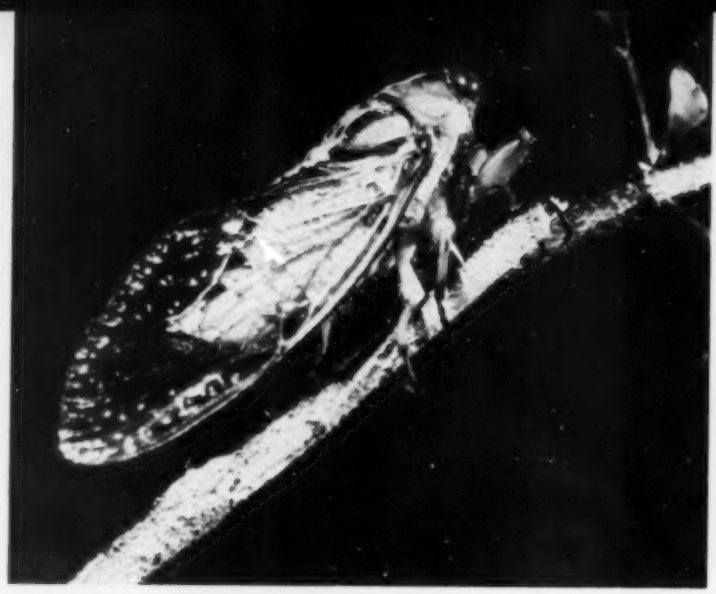


Entomologists with the expedition used a white cloth and kerosene lamp as a trap for night-flying insects. In this photograph, C. J. Lindsay, who was making a collection for the Dominion Museum, coaxes a moth into his specimen jar.

The larger moth on this temporary mounting board (shown above) is a rare species of New Zealand night-flying moth, the *Melanchra merope*. It is of a rich brown colour with greenish markings.

An entomologist from the Cawthron Institute, L. J. Dumbleton (right), examines insect specimens. During his stay he made a special study of sandflies, which are prolific in the Caswell Sound area. By way of compensation to human feelings, no mosquitoes were found there.

Another entomological specimen is the cicada, this one (right) of the *Melampsalta muta* species. This insect, which is common in New Zealand, makes its song by rubbing its legs against its body and shaking its transparent wings.



Fish caught in the sounds were a welcome addition to the menu. On the left is a 50-pound groper, known in New Zealand as "haupuka" (*Polyprion oxygeneios*), being prepared for cooking.

Two members of the Marine Department, B.T. Cunningham and D. J. Anderson, use a small seine net to catch native trout in the Ethne stream, which runs into the upper Stillwater.

A party of four from the Lands and Survey Department made a detailed topographical survey of about 100 square miles of country. Their job was to provide height and position control for mapping from aerial photographs. For the first month they were not able to do much because of the torrential rain, but they wasted no time in covering the country when the weather cleared. Though their task was routine, they had to carry their 60-pound packs over country that was anything but routine. On one occasion the surveyors had to spend two days snowed up in their special alpine tent at 4,000 feet because of a severe blizzard. The photographs show them operating with theodolites in different types of country.

A cascade on the Katherine River, with Mount Henry in the background.

When the expedition began to disperse, scientists who had finished their investigations left by sea for Milford Sound but Dr. Murie and a small party headed inland, going south from the eastern arm of George Sound and up the Katherine River to small Lake Katherine. The photograph above shows three of the party crossing Lake Katherine in a portable rubber dinghy. Mount Henry is at the left.

Scientists making their way overland from the base camp encountered many obstacles. To help them in some of their water-crossings special wire rope suspension bridges were slung. The picture at right shows three members of the survey party crossing a wire bridge.

On his final trip, Dr. Murie and his party after crossing Lake Katherine climbed to Henry Saddle and so across the divide, descending on the eastern slopes to Lakes Thomson and Te Anau. The Saddle and mountain were named after Richard Henry, who discovered the route from Te Anau to George Sound in 1889. In the photograph above, approaching Henry Saddle, Mount Elwood (4,140 feet) is in the background. The party was caught in a blizzard in Henry Saddle and had to camp for two days. The picture at left shows their fly camp after the heavy snow.

From the second base on the beach at George Sound (above) the members of the expedition gradually dispersed. Though Operation Fiordland was over, study of the material gathered continued. Mr. R. Foster (below), entomologist, found several kinds of tiny creatures which might be termed living fossils, Fiordland having apparently offered a refuge for many archaic forms of invertebrate life. He discovered some primitive spiders of a family first known from specimens preserved in Baltic amber. Living specimens have been found in other parts of the world but this find brings the number of New Zealand species of this spider to five, or at least half the total known number.

# Busy Nottingham

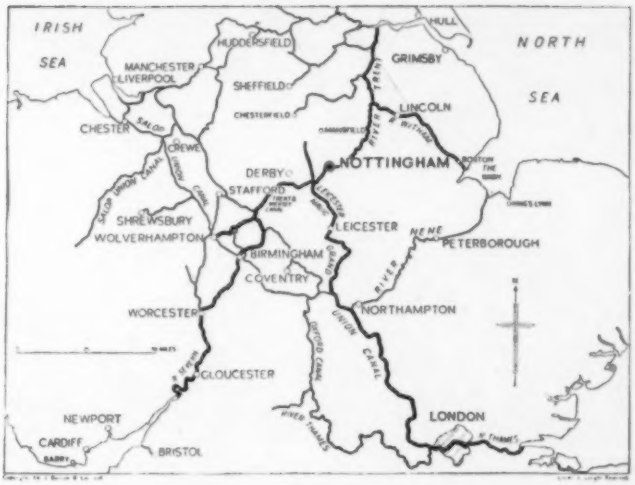
*by* W. H. CORKILL

C.O.I. Photographs

THE PEOPLE of Nottingham view with some scepticism the legend of Robin Hood, the bold, benevolent brigand closely associated with that city and Sherwood Forest. His name is less important to them than many local names that have attained fame in the industrial world. Certain scholars think that Robin Hood was a pre-Celtic ruler of much goodness and wisdom, whose story has become enmeshed in Celtic imagery; and archaeology offers evidence that prehistoric man was active in the district. The Romans, however, appear to have by-passed the site of Nottingham, a surprising fact when one realizes that the River Trent connects it with the North Sea. The Angles and Saxons showed more discernment, calling the place, Snottingeham—"the home of the wise men", a prophetical title. Three centuries later the Danes assumed command and the town was fortified. William the Conqueror arrived here in 1068, but there was so much friction between the townsmen and the French that the town was divided into two racial boroughs, with a common market place; and a wall dividing the market place was necessary to keep the two peoples from cracking each others skulls.

Nottingham, a place of industrial importance in 1086, according to *Domesday Book*, earned the attention of king after king with charters to grant in return for something tangible. Henry II granted the town its first charter about 1155, and the eight-day Goose Fair, still held annually, was already well established when, in 1284, Edward I granted a charter to hold a fifteen-day fair. Perhaps the wide fame of Nottingham ale made these

*At top:—Looking across the Old Market Square in the centre of the city towards the modern Council House, opened in 1929. Formerly the old market place where Goose Fair was held, this was, until about twenty years ago, the largest open-air market in England.*




fairs attractive more than did the products of the weaver, dyer, tanner and the iron worker. The silent Trent helped those industries to expand by providing inexpensive transport of exports into other counties.

Kings and queens visited Nottingham in an endless stream; princes and nobles battled among themselves, but the traders and citizens of Nottingham remained industrious, and their town expanded. Perhaps the most important event in the civic story, following the visit of Norman William, was the invention of the stocking frame in 1589 by the Rev. William Lee of nearby Calverton. The doings of the Tudors and the Stuarts become unimportant beside that invention, for the machine, adapted and modified, laid down the foundations of Nottingham's modern growth and fame. The town's other main industry was lace and by the end of the nineteenth century, Nottingham lace was in world demand. In 1897 the busy town became a city

This development was not fortuitous. Lying near the toe of the Pennine Range, Nottingham enjoys easy access through the valley of the Trent to the North Sea ports of Goole, Hull, Immingham and Grimsby, or by way of the River Witham to Boston. When canals were made, the Trent and Mersey Canal linked the city with Manchester and Liverpool, and the Grand Union Canal formed a water-link with London. Coal and iron accelerated the Industrial Revolution; Nottingham is close to one of the most valuable coalfields in Britain, and an ironstone area lies but a few miles away. Thus, located in the industrial centre of England, with fast and efficient passenger and freight train services, at the hub of a network of motor passenger and freight haulage systems, and with a modern airfield on its doorstep, Nottingham was more or less forced by geographical location into industrial prominence. Efficient local administration maintaining low rates merely accelerated this development while providing for the future.

*Besides its usefulness for commercial transportation, the River Trent adds to the amenities of Nottingham. This view is looking downstream to the Trent Bridge.*

*The technical experts of a lace-making firm discuss in conference a problem which is worked out on the 'draught' — the plan by which the lace is made.*

*Men operate the heavy machinery. Here the manager points out necessary improvements. With the assistance of the 'draught' the threads requiring to be re-weighted are separated.*

The modern Nottingham belies its past, for, rich in spacious boulevards encompassing the city, it wears a modern air which camouflages its history. Old-time names like Cheapside and Poultry suggest the past, but the Old Market facing the Council House is a triumph of the landscape artist. The Black Boy Inn, famous in bygone days as an inn where travellers fed and rested while horses for the stage coach were being changed, may be ancient in days; in accommodation, cooking and service, it cannot be surpassed in any country. Nottingham betrays its age only in that apparently effortless service and modesty which is the product of long experience. This trait is found in the city's industries.

Nottingham is world-famous for its lace. Chantilly, Pointe de Paris, Valenciennes and Binche were mysteries to me until I watched a Leaver lace machine in operation at the factory of Birkin and Company. The design for the lace is made by an artist, and then is translated into a maze of numbered squares and spaces. I saw no less than 9,000 numbers on a design measuring only 18 by 36 inches. The pattern is then transferred to Jacquard cards, a series of holes in each card governing the movement of needles in the machine while the lace is being woven in cotton, silk, rayon or nylon.

The actual process is one of uniting loose threads with taut threads, thus making a pattern; and there may be 106 threads in every *inch* of the lace; but, every thread must be perfect. The bobbins used in a nine-ton machine consist of brass circles riveted together in pairs. There may be as many as 32 bobbins used to the inch, each containing up to 270 feet of thread. As the weaving entails 140 mechanical motions per minute, the precision demanded makes the miniature camera seem clumsy in comparison. The amazing feature of the machine is the steel control bars, links between the Jacquard cards and the needles. Each is a length of strip metal one-fifteenth of an inch thick, so thin that it is affected by the temperature of the room. Little wonder, then, that the weaver requires seven years' apprenticeship to learn how to operate the machine, and that ten years' experience gives a man only a good working skill with it. A shortage of skilled operatives keeps the demand for this lace ahead of the supply. One pattern of lace contained silk so fine that 86,000 *yards*

of the thread weighed only one pound. There is no need for the weaver to say, "Every thread perfect", for the visitor speedily accepts that claim as a Nottingham tradition.

All manner of lace is woven in and around Nottingham. Laces for the creations of the couturiers of London, Paris and New York, lace furnishings—whatever the demands of fashion or taste, Nottingham can meet them unhesitatingly. Allied to the industry is the making of hair-nets, mosquito nets, plain nets and Jacquard cards. It is not surprising that this city, the world's largest lace-producing centre, at which machine-made lace was introduced and developed, has yielded names famous the world over—names such as Birkin; Simon; May; Peach and Sons, Raywarp; Nuart; Marquise; Halo; Witchcraft and others.

Romance and hosiery are close allies in Nottingham, for although we are not certain when hand-knitting first came to Britain, we know that King Henry VII wore silk stockings made in Spain, and that Queen Elizabeth also wore silk stockings, while the mass of her people sought warmth for their legs in cloth. The art of knitting stockings soon spread across the country, but the big advance was made when Lee invented the machine for the manufacture of a looped or knitted fabric. The home of the machine hosiery trade, Nottingham is still a foremost hosiery centre, employing over twenty per cent of the total employees in the British industry. Whatever the garment, Nottingham can make it.

Nottingham people are justly proud of three names bathed in romance. In 1863, a boy of thirteen left school to tend the shop of his widowed mother. It was a place at which one bought soap, camomile, senna leaves and other simple herbal remedies. The boy spent much of his spare time reading books on pharmacy, and the day came, in 1877, when he opened his own shop in Goose Gate, Nottingham. It bore the sign, "J. Boot, Drugs and Proprietary Articles at Reduced Prices". The new druggist believed in small profits and quick returns, and he was convinced that the highest purity in his drugs would create confidence and convert occasional customers into regular clients. Challenging competition, he faced a dour struggle. He gave no credit, and by 1880 he was known as "Boots, the Cash Chemist".

By then the business was becoming too big for the shop; it had to expand or die. Branches were opened, at first in Nottingham and then in nearby towns. More capital was needed; in 1883 Jesse Boot and a few friends formed the firm of "J. Boot and Co., Ltd." To ensure the high standard of purity

*Lace is made in rolls of full machine width, the roll consisting of strips of lace joined together by draw threads.*

*Taking out the draw threads to separate each strip of lace from the machine-wide roll on which it is made.*

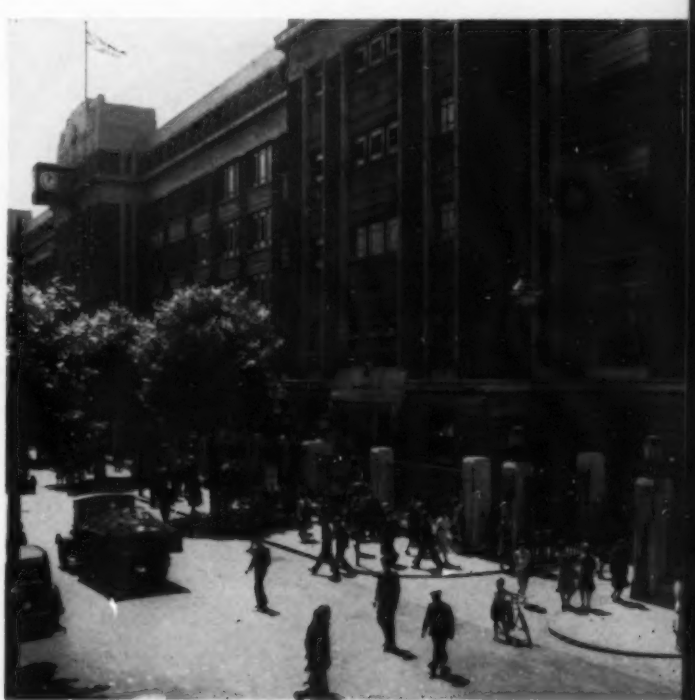
*This lace finisher has been fifty years in the industry.*

which Boot demanded in his drugs, the firm commenced manufacturing drugs and pharmaceuticals in Nottingham. Today, "Boots Pure Drug Co., Ltd." employs over 10,000 workers in three factories in Nottingham alone. The major factory, at Beeston, one of the finest chemical and pharmaceutical plants in Europe, is a small town in itself. Here among the poplars and oaks stand immense buildings notable for their cleanliness, modern equipment and economical procedure. From Beeston go all manner of the purest fine chemicals, medical products, pharmaceutical specialties, toilet preparations, veterinary and horticultural products, to all parts of the world.

Associated companies, such as Boots Pure Drug Co. (Canada) Ltd., have been formed in the Dominions. The key staffs of such companies are initially Nottingham-trained, and then are augmented by locally-recruited staff. The tiny shop in Goose Gate has expanded into an organization having 1,280 retail branches in the United Kingdom; with associated companies in Canada, South Africa, Australia, New Zealand, India, the Far East, Pakistan, Fiji, and with agents in many lands. It is a remarkable achievement within ninety years. Jesse Boot, First Baron Trent of Nottingham, is remembered by his native city for his kindly treatment of his employees, and for his princely benefactions, specially University Park, and for the buildings he erected for the University of Nottingham. He was the happy warrior who won over good men to his side by his own goodness.

In 1877, John Player became the owner of a Nottingham tobacco factory employing 150 work people. In those days, one asked merely for tobacco. Player introduced the packaged tobacco, and to induce smokers to ask for his wares he placed a picture of Nottingham Castle as a trade-mark on his packets. A little later he used the famous sailor's head within a lifebuoy as a trademark, and the demand for Player's cigarettes and tobaccos began to leap. When the Imperial Tobacco Company (of Great Britain and Ireland) Ltd. was formed, Players became a part of an organization which successfully preserved the names and individuality of the constituent businesses. Associated companies were formed overseas to solve marketing problems. Today the firm of John Player and Sons employs more than 8,000 in the Nottingham factories, and the city is one of the three largest tobacco manufacturing centres in the United Kingdom.

Hong Kong doctors told a Mr. Frank Bowden, also in 1877, to "Go home. You have only a few months to live". He obeyed. In Harrogate he was told by his doctor to ride a bicycle, in those days a novelty. He did so, and within a few months was restored to health. Realizing the value of getting people into the open air, Bowden sought the makers of his machine, and found twelve cycle-makers at work in Raleigh Street, Nottingham. He took over the firm, financed and developed it as the Raleigh Cycle Co. Today the firm which, at its inception, produced three cycles per week produces a little more than five cycles every working minute.



*One of the buildings of John Player and Sons, the tobacco firm.*

*The Raleigh cycle factory is the largest in the world. Raleigh Industries make every one of the 2,000 components that go into a bicycle except the saddle and tires.*

The output for 1950 will be almost 1,000,000 cycles, but that volume will not satisfy the demand, for Raleigh cycles go from this factory covering forty acres, the largest cycle factory in the world, to more than 100 countries.

There are from 1,200 to 1,500 components in a Raleigh cycle, and most of them, except for parts using rubber and leather, are made at Nottingham. Here one sees strips of metal converted in a twinkling into tubes or mudguards; every operation is done at high speed and lynx-eyed inspectors at every stage enforce Bowden's motto, "quality comes first". The atmosphere of the shops is one of eager industry, and the workers, so casual and effortless in their operations, have no doubt that the Raleigh is "the most complete cycle in the world". Six thousand employees went in special trains to the seaside, this summer, and each, from the managing director to the office boy, was given a packed lunch and three dollars to spend on the trip. That reveals the happy employer-employee relationship in a nutshell.

The predominance of the textile industries in the Nottingham district has overshadowed the local engineering industries, with their immense resources of raw materials and fuel. Yet practically the whole of the lace-making machinery used throughout the world was made in Nottingham; hosiery and auxiliary machinery manufacture is an old and prosperous local industry; the most modern railway practice is employed at Taylor Brothers (Sandiacre) Ltd. and other Nottingham works; the absence of thick smoke from factory chimneys is the finest possible advertisement for locally-produced patent furnaces and fire-bars; there is a vast local electrical engineering industry, and of boiler-making, and so-forth, there seems to be no end.

All these are but some of the industrial activities which have carried the name of Nottingham to the four quarters of the world; more than 1,100 members of the Nottingham Chamber of Commerce, one of the most progressive and aggressive organizations of its kind, are required to represent the many, varied local industries and professions. But Nottingham has much more than industrial activities to offer the visitor.

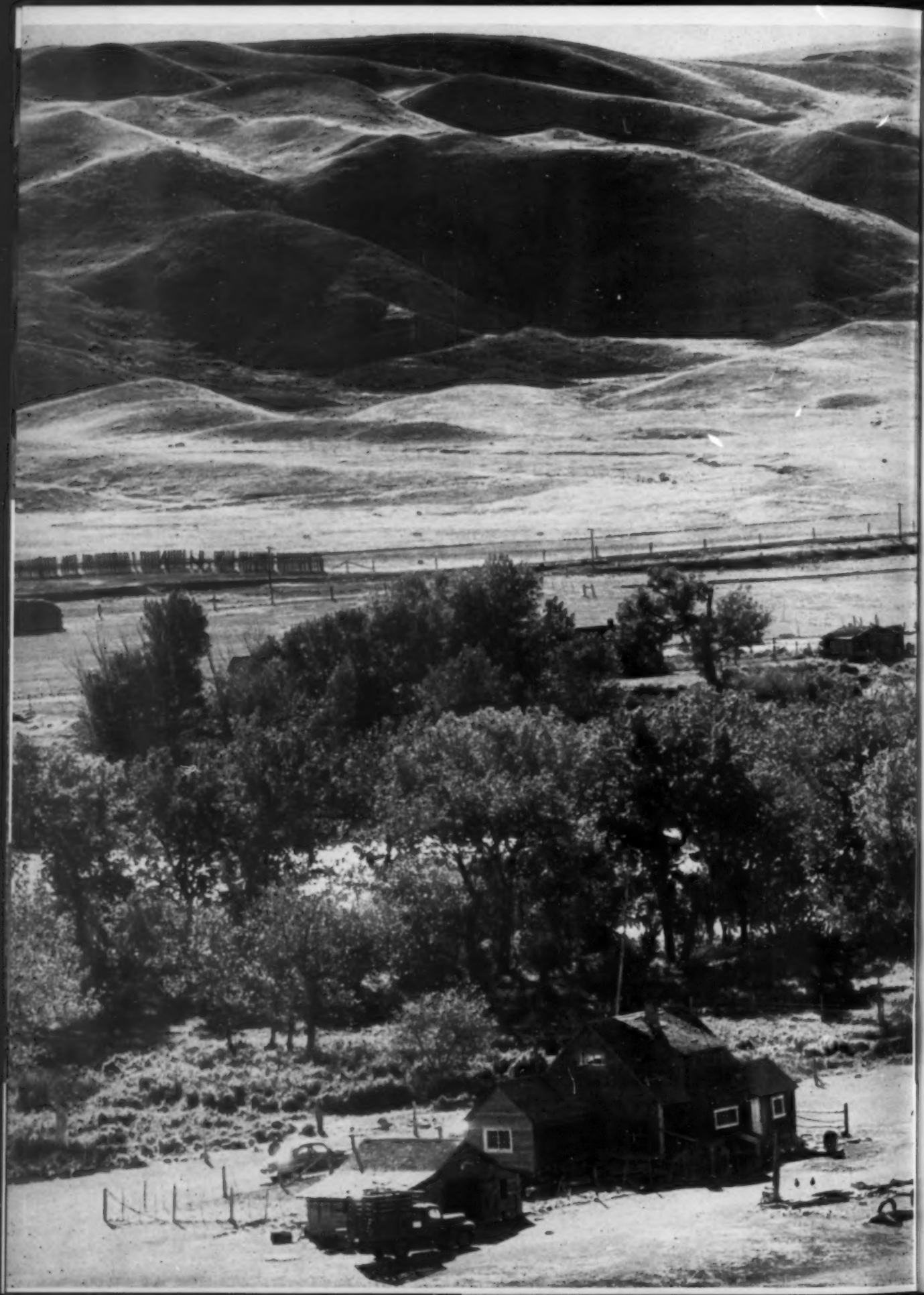
*The 170-mile-long River Trent is the chief river of the Midlands. Cargoes are transferred from ship to barge at the seaports and carried direct to many cities by inland waterways.*

Its boulevards and open spaces, its modern housing estates, are gems of town planning. It could become a leading Tourist centre.

The hotel and restaurant services are superb, and whatever one's desire in sightseeing, there is something for everybody within easy motoring reach. For the literary-minded there are Newstead Abbey where Byron lived, and Hucknall where he lies beneath the church floor; Eastwood is rich in D. H. Lawrence associations; Samuel Butler was born at nearby Langar; Grantham treasures its associations with Sir Isaac Newton, and Sherwood Forest can still flaunt the ghosts of Robin Hood, Maid Marion and the bowmen in green. Should one desire architectural feasts, there are the Elizabethan Wollaton Hall within the city boundaries; cathedrals at Lincoln, Lichfield, Peterborough and Southwell Minster; parish churches rich in Saxon and later work at Grantham, Newark, Breedon-on-the-Hill, and at scores of other places. There are castles and battlefields, mansions and thatched cottages, peaks and forests, lush valleys and whole fields ablaze with flowers, all within easy reach of Nottingham. There are wide-eyed deer at Wollaton, and foxes and hounds at Belvoir; while the resorts of Skegness and Mablethorp on the Lincolnshire coast are but a short ride away. Nottingham is indeed blessed by her geographical setting, industrially and in every other way. And that, perhaps, explains the friendly, courteous nature of the Nottingham citizen, and his patent eagerness to assist the stranger who enters within the gates of his city, the ancient City of Snottingeham—the home of the wise men.

*The "Trip to Jerusalem", which claims to be the oldest inn in England. The name means that it was a "trippe" or halt on the Crusaders' road to the Holy City.*

*The fine, modern factory at Nottigham of Boots, the internationally-known firm of chemists.*



# Ranch Round-Up

*by* LYN HARRINGTON

*Photographs by* RICHARD HARRINGTON

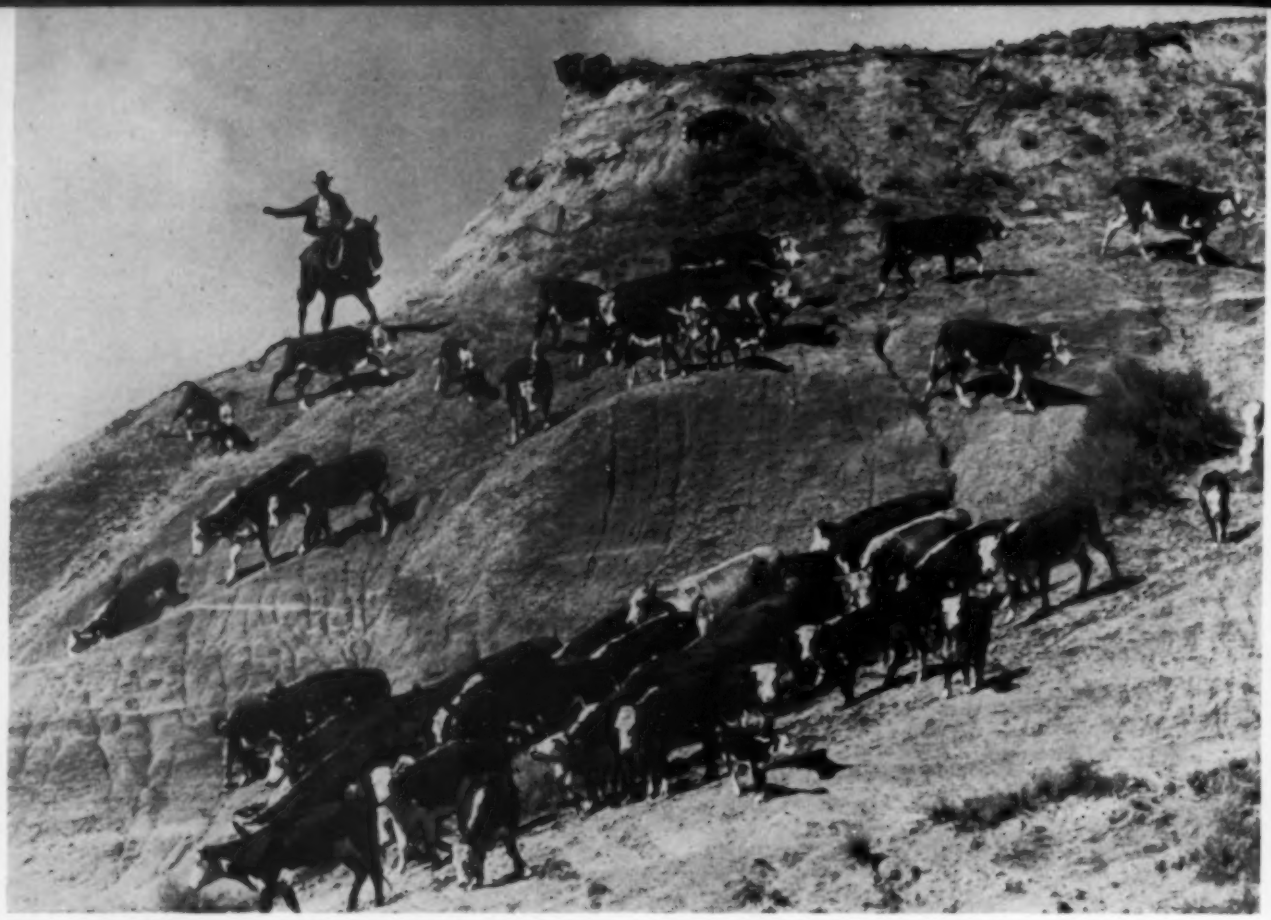
ROUND-UP, branding and rustling, far from being relegated to western stories and movies, are integral features of the great cattle-ranching industry of the Canadian west. Alberta still leads as the important ranching province, followed by Saskatchewan and British Columbia, and, afar off, by Manitoba.

Round-up comes twice a year. Once, in the early summer, the calves are rounded up and hazed into a corral to be branded with the indelible mark of ownership. Again, in the fall, cowboys gather in the herds of cattle from the hills and *coulées* to select those for shipping to market. On large ranches, the round-up may be a job of several days, requiring the united efforts of all the ranch hands and the neighbours as well. On smaller ranches, the neighbours co-operate with one another, and the work is usually accomplished in a single day.

It starts in early morning, when the cowboys down a hurried breakfast, saddle their well-trained cowponies, and ride out into the hills. They find the cattle scattered over a wide area, near the springs, in the "draws", in the open country and wherever there are trees. With the assistance of a dog, the cowboy gets the herd "on the prod" to the corrals. On large ranches this alone may take several days.

In the corrals, the cattle mill around raising clouds of dust, occasionally bawling in bewilderment. The cowboy selects an un-

*Above:—On his way to round up cattle pasturing on the rolling hills beyond, a cowboy fords the river beside the ranch house shown opposite.*



*Whooping unaffectedly, the cowboy hazes cattle over bare, eroded hills to the branding corral.*

branded calf, whirls his lasso, and drops it neatly around the calf's hind legs. A lunge, and the calf tumbles to the ground. The cowpony, alert to every movement of the rider's knees and acting almost as part of him, edges back to hold the rope taut. At the word of command, the calf is eased over the ground to the waiting cowhands.

The frightened calf bellows in alarm, but the operation does not take long. Two ranch hands hold the calf so that it does not jerk at the searing touch of the hot iron, and so blur the brand. Another assistant brings the long-handled branding iron from its place in the wood fire just outside the corral. Then he presses the red-hot insignia—letters, numerals or symbols—on the calf's hide in the approved position. The location of the brand is determined in the Brand Registry office, and may be hip, side, shoulder, neck or jaw, though the two last are avoided if possible.

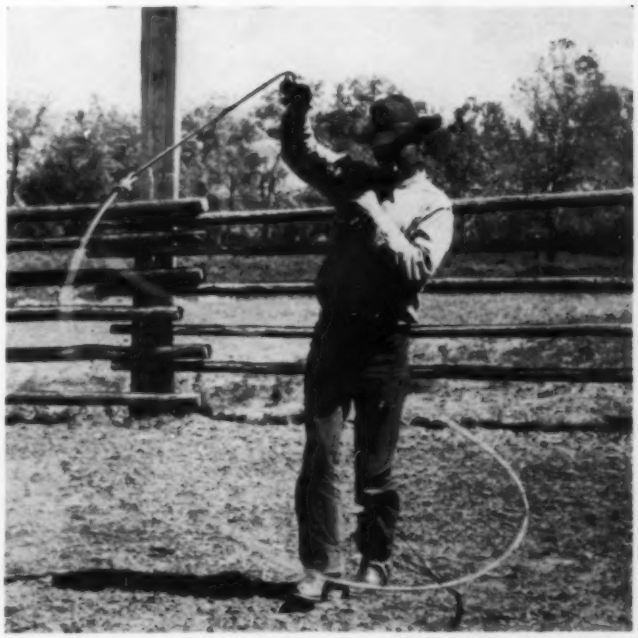
The branding is painful, unquestionably, but no other satisfactory method has been devised to identify one Hereford from another, and thus prove ownership. A notched ear or dewlap is a second mark of ownership, for easy identification at a distance. Each calf gets further treatment of "shots" against blackleg, and shipping fever (*hemmorhagic septicemia*). Young bulls are also castrated at this time, and struggle to their feet as steers.

A second round-up on a smaller scale may be necessary again in the early summer, for very young calves are not branded. The hide is tender, and the branding is less of a shock to the calf's system when it has had more than two months' growth. On a large ranch, a cowboy riding the range occasionally comes upon a calf missed in the round-ups. He builds a fire, heats a rod or perhaps a horseshoe, and "runs a brand on the maverick", drawing on the ranch emblem freehand.

The brand is essential where cattle mingle with the neighbours' animals, as on open range. It is equally valuable in preventing

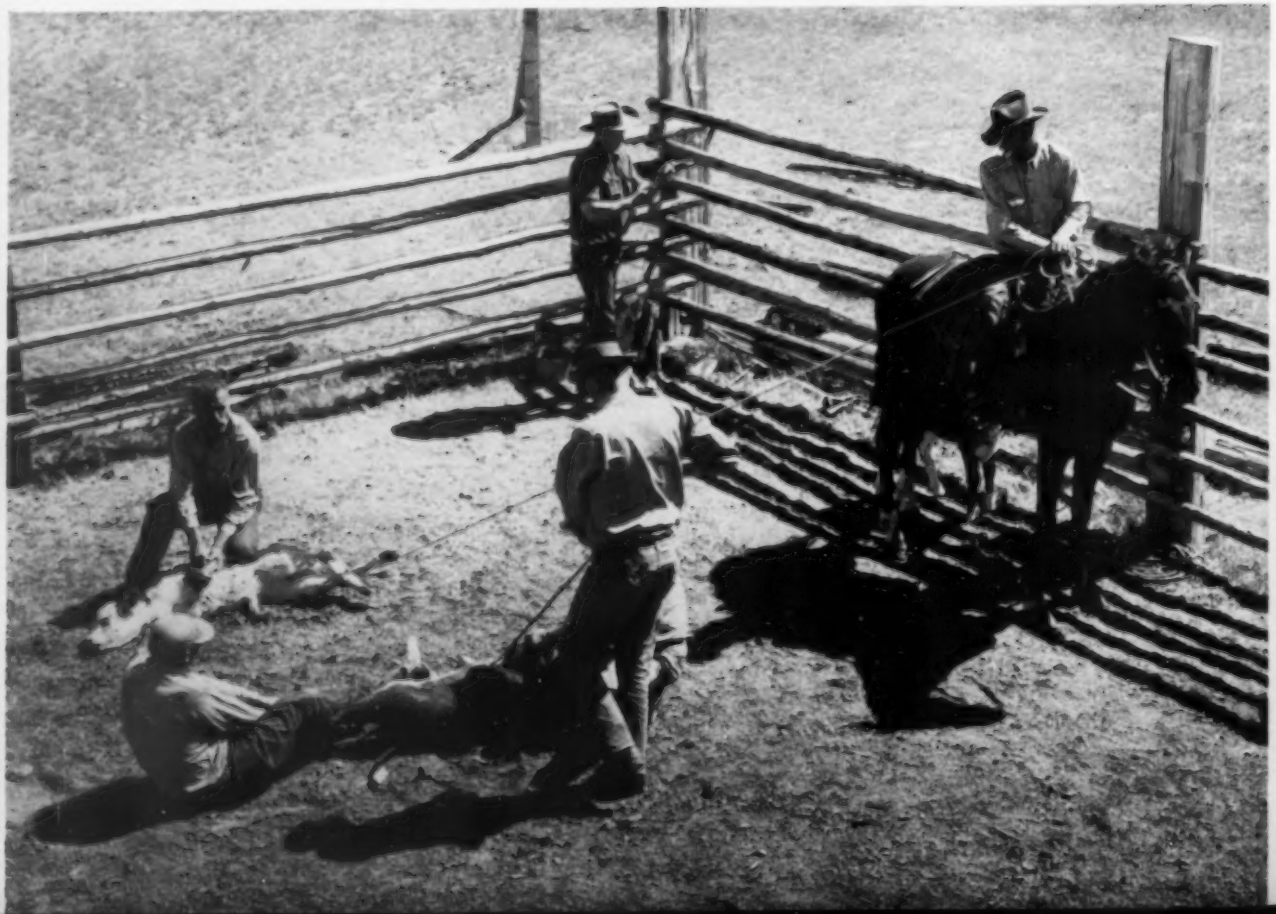
*This calf changed his mind about the whole thing, but the pony is after him in a flash.*

*Below:—Skill with a rope is vital to the cowboy. This may look easy, but just try it some time!*



cattle-stealing, although modern rustlers rarely bother to "blot a brand". They are more apt to bury the hide, or forge a bill of sale.

The second large round-up comes in early autumn, when the cattle are driven to the freighting-yards and stockyards. At the latter, government inspectors check to make sure that the animals brought in are the actual property of the shipper. The brands on the cattle must coincide with the shipper's brand as listed in the provincial Brand Books; or he must produce evidence of ownership by a bill of sale. Although it has not ended cattle-stealing, this final checking has greatly curbed it. Brand readers receive ten cents per head, a charge which is insignificant, considering the number of illegal shipments which they stop.



*Above:—Some of the old brand marks of Medicine Hat an important cattle-ranching centre of Alberta ; these are being replaced by more efficient, but less picturesque, numerals. It is sometimes necessary to shear off the hair of mature cattle to enable the brand-inspector to read the brand.*

*Left:—White-faced Herefords (they appear practically identical) being herded into the corral; there the calves are lassoed and thrown, well-trained ponies holding the lariat taut while cowhands brand, castrate and inject serums.*

*Below:—After a hard day's work the cowboys roll their cigarettes and relax.*

**EDITOR'S NOTE-BOOK**

Lorne Manchester is a native of Ottawa. His twelve years of newspaper work, on an Ottawa paper, were interrupted by a break for military service. For four years he served in the army in Canada and overseas, being discharged with the rank of captain. Early in 1948 he joined the Department of Fisheries as writer and editor and since then he has travelled Canada from coast to coast making a first-hand study of fishing operations and the research and development which so closely affect those operations.

* * *

Lyn and Richard Harrington, wife and husband team of writer and photographer, travel to all parts of the Dominion and record the many aspects of the Canadian scene in story and picture. Their work is well known to readers of the Journal and many other periodicals.

* * *

W. H. Corkill, European representative of the Society and a Fellow, is a publisher and writer living at Ramsgate who has, nevertheless, travelled in Canada from coast to coast over a period of years. A veteran of World War I, he was transferred from the Reserve of Officers to the R.A.F. in 1940 and sent to Western Canada, where he served as a staff officer attached to the R.C.A.F. until 1944. Since returning to England, S/L Corkill has, amongst other activities, edited his own nature-study magazine, *Mainly about Animals*.

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## AMONGST THE NEW BOOKS

**Principles of Structural Geology**

*by Charles Merrick Nevin*

Fourth Edition, 1949

(John Wiley & Sons, New York, $6.00)

This popular text appeared first in 1931 with later editions in 1936 and 1942. Its author is professor of Geology at Cornell University; in addition to his work in teaching he has had a great deal of practical experience doing professional work particularly in the fields of structural and petroleum geology.

The present edition presents a number of new features. Probably the most important of these is the inclusion of a very useful extra chapter at the end of the volume devoted to laboratory exercises concerning problems that are presented in connection with field studies and in the preparation of maps and reports.

Structural geology is that branch of geology which treats of the ways in which rocks are deformed and the causes that produce such deformation. The first part of the book deals with the way in which rocks yield under pressure such as by folding, fracturing and the development of cleavage. How rock structures are reflected in the topography is next discussed and this is followed by broad considerations concerning the oceans and continents and the characteristics of mountain systems. Where such controversial questions as isostasy, continental drift, etc., are dealt with they are presented from a factual point of view and in an impartial manner. This new edition should meet with an even more favourable reception than did its predecessors.

F.J.A.

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